



GLM Lightning Optical Energies

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Overview

- Analysis
- Sample Daily Plots
- Frequency Distribution
- Spatial Variation
- Diurnal Variation
- Trend of Daily Mean Energy

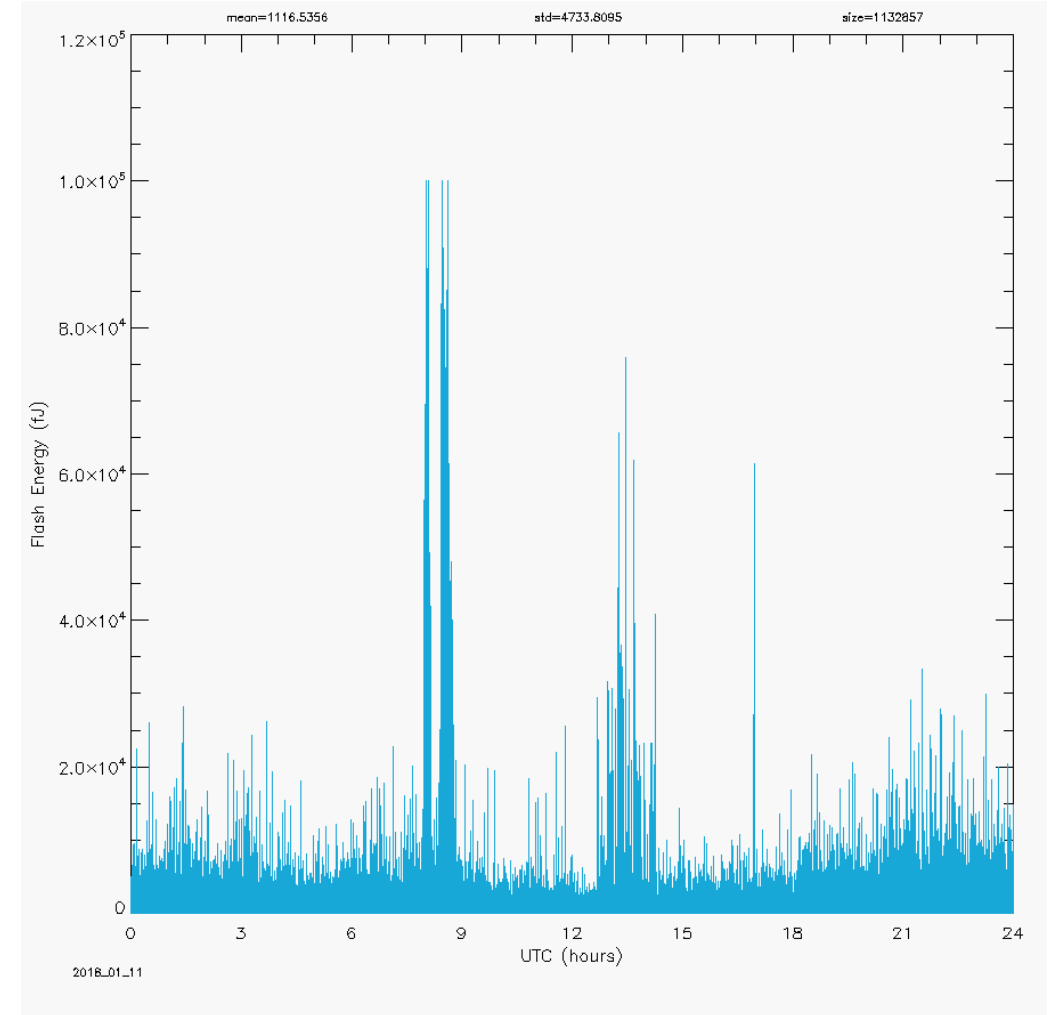
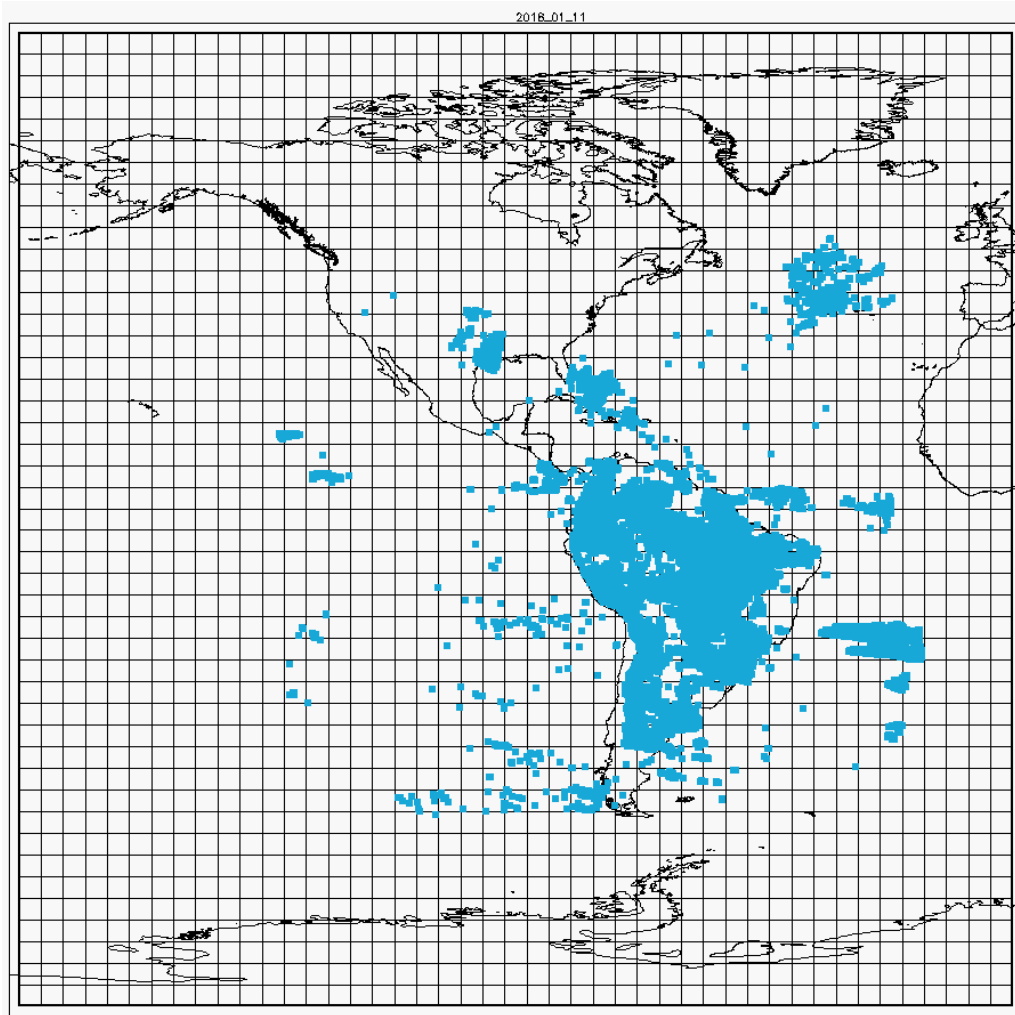
Analysis

Analysis

- **Region:** Entire GLM FOV
- **Period:** 11 Jan 2018 - 11 Jun 2018
- **# Days:** 152
- **# Flashes:** 121,073,578
- **Filtration:** None (so energy biased by glint, radiation dots, ...)
- **Emphasis:** On long-term trending of full flash data product as we move through s/w fixes.

Sample Daily Plots

Sample Daily Plots (first 60 days)



Frequency Distribution

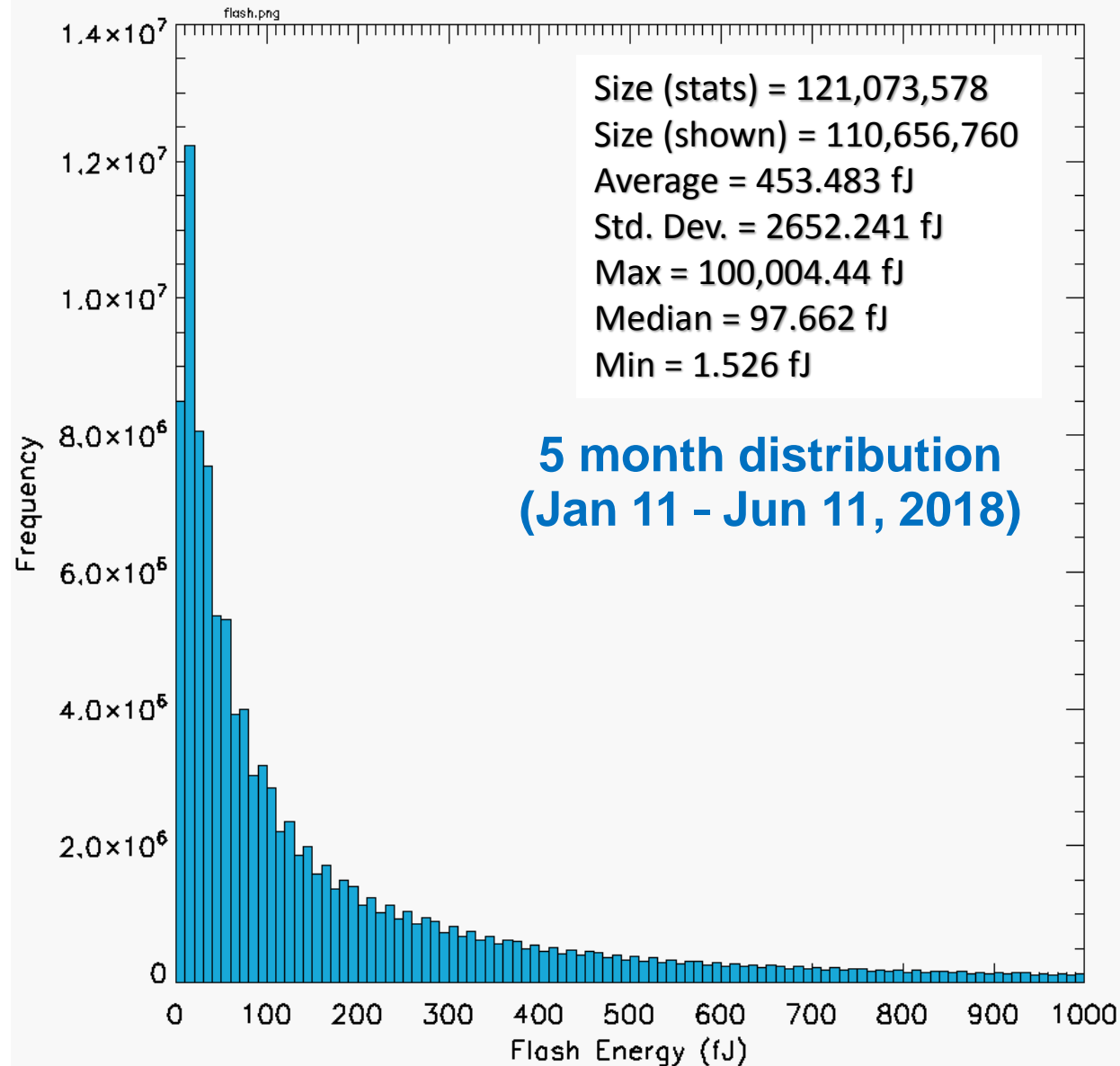
Summary

Heritage Flash Amplitude Baseline Computed by Koshak Using Raw Data Results from Various Investigators

Raw Data Source	Koshak OTD CONUS 1999-2000 Z = 3 weighting Resolution Model	Koshak OTD CONUS 1999-2000 data weighting Resolution Model	Buechler & Christian LIS GLOBAL 1998-Jul 2001 Pre-boost Resolution Model	Buechler & Christian LIS GLOBAL Sep 2001-2013 Post-boost Resolution Model	Buechler & Christian LIS GLOBAL 1998-Jul 2001 Pre-boost Res: data 22.6 km ²	Buechler & Christian LIS GLOBAL Sep 2001-2013 Post-boost Res: data 25.3 km ²	Beirle et al. LIS GLOBAL 1998-2012 both Pre- & Post- Res: BC data 24.7 km ²
Koshak Computation	79.8	72.8	55.7	57.9	67.9	59.9	60.3

- OTD: poor sensitivity, only CONUS stats done, Z estimate ... not best to use.
- More data in LIS Post-Boost than in Pre-boost ... so Post-Boost better sample size
- Buechler & Christian study has 1 more year of data than the Beirle et al. study, and more specific mean event footprints (since Beirle didn't separate out Pre-boost from Post-boost).
- So best estimate currently is 6th column above (bolded).

$$\left\langle \xi_{\lambda}(\hat{\Omega}) \right\rangle \sim 60 \frac{\mu J}{m^2 sr \text{ nm}}$$

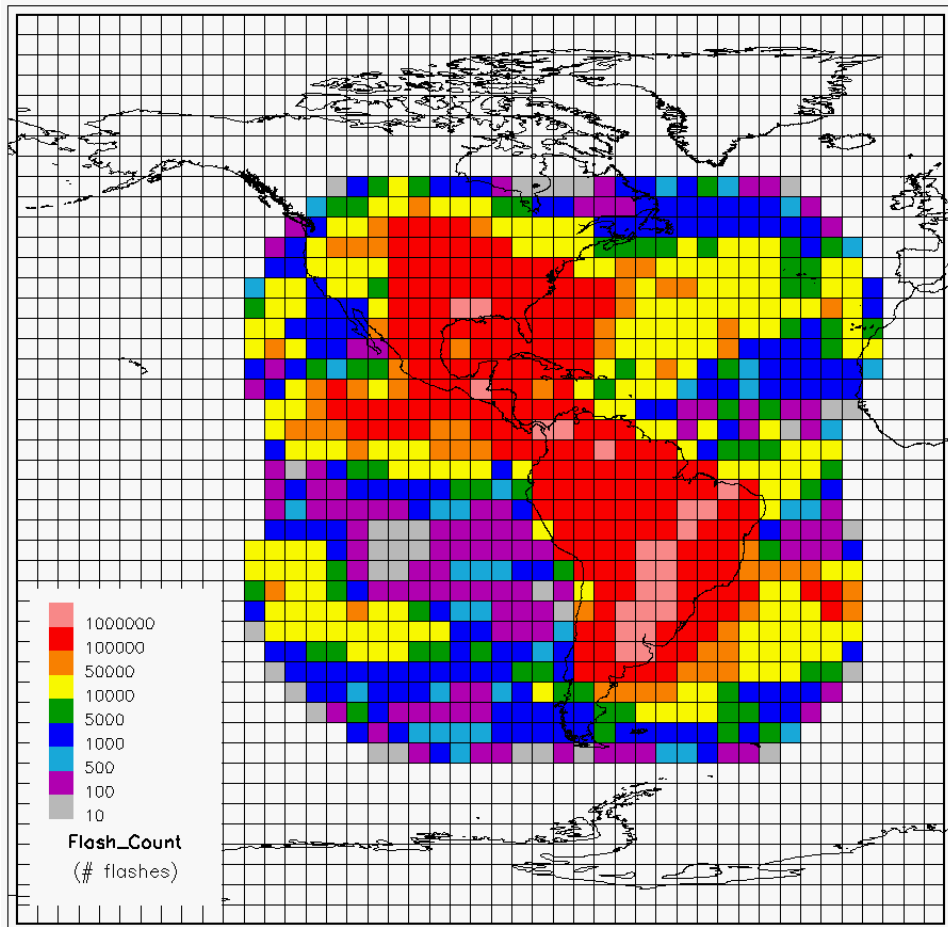


Frequency Distribution of Flash Energies

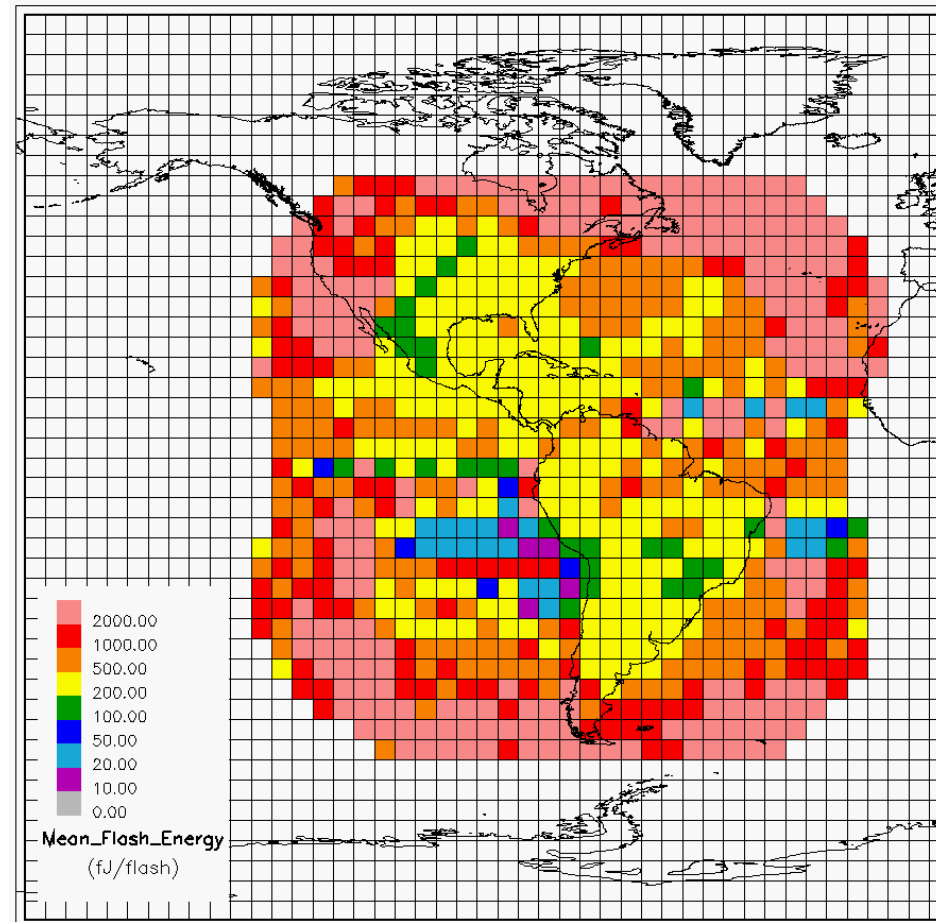
Spatial Variation

Spatial Variation

Flash Counts



Mean Flash Energy



Flashes more energetic over oceans, for sufficient sample size. Agrees with TRMM/LIS findings in Beirle et al. (2014).

Flash energy increases towards limb since:

- pixel size decreases
- filter roll-off
- side/beneath cloud detection.

Diurnal Variation

Diurnal Variation

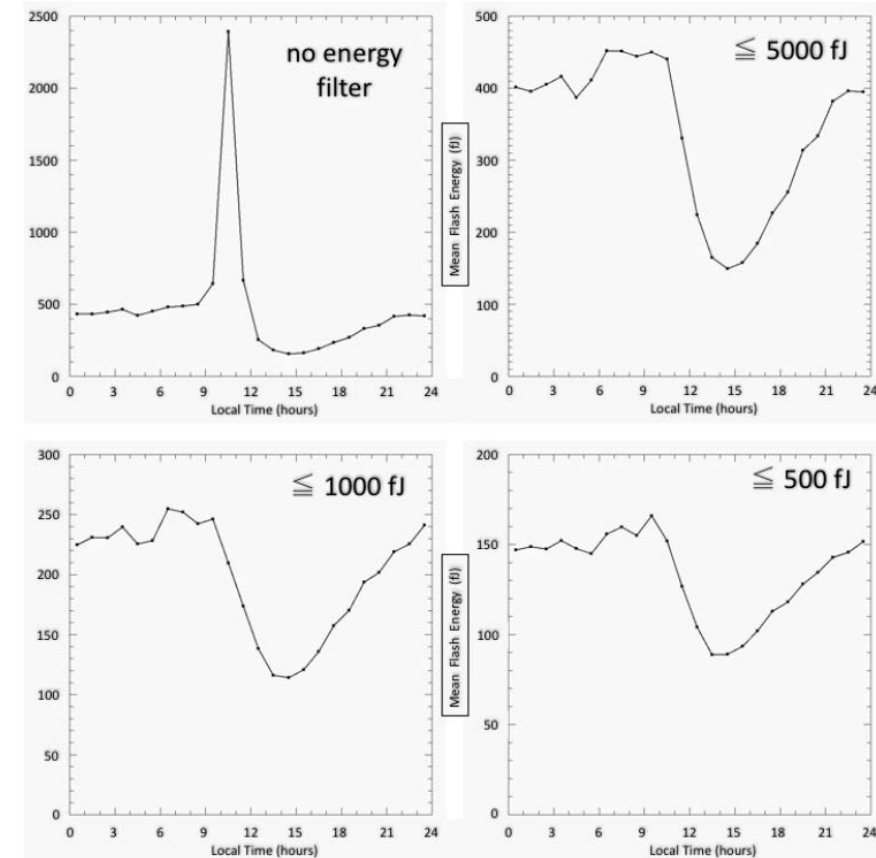
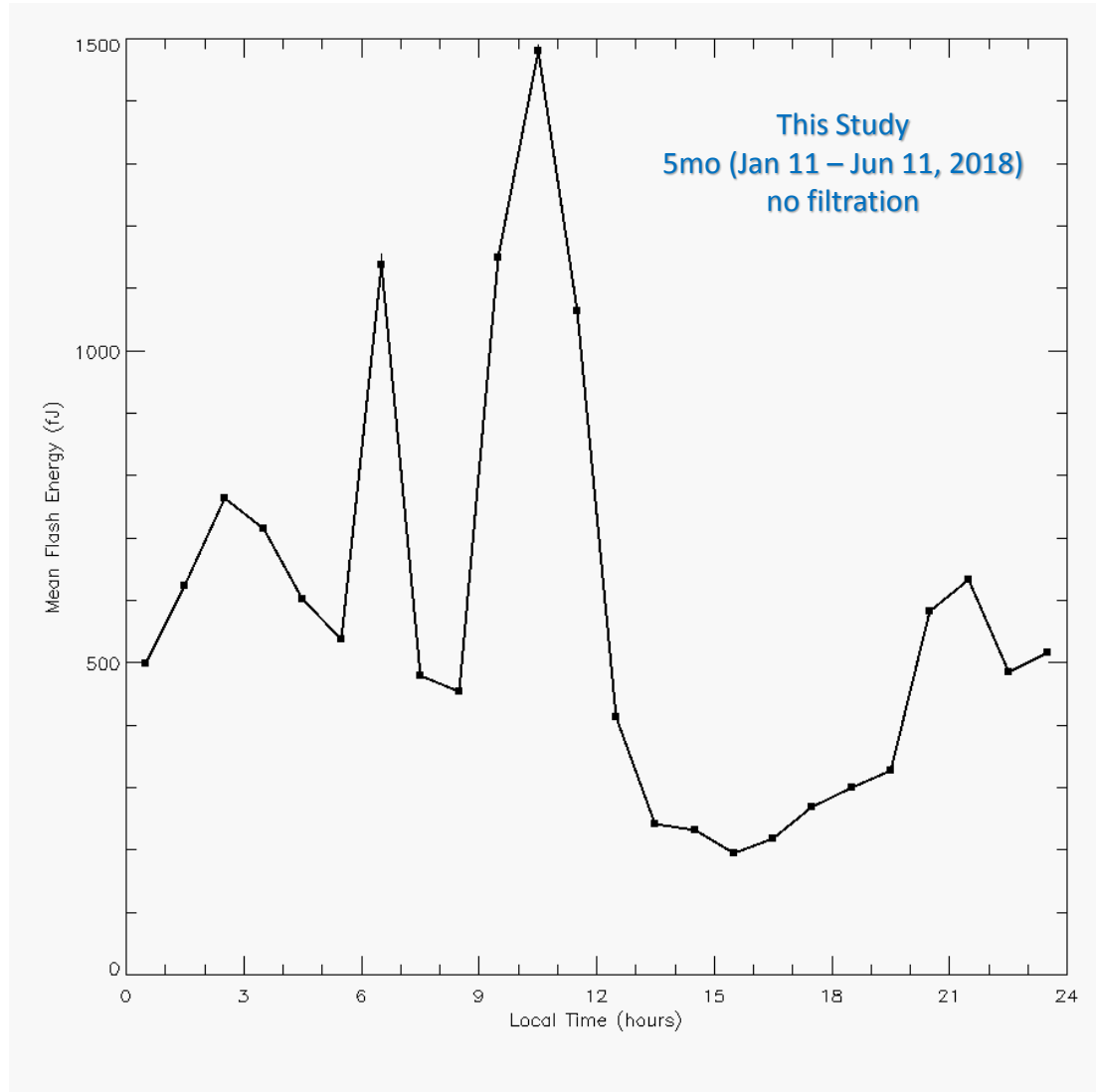
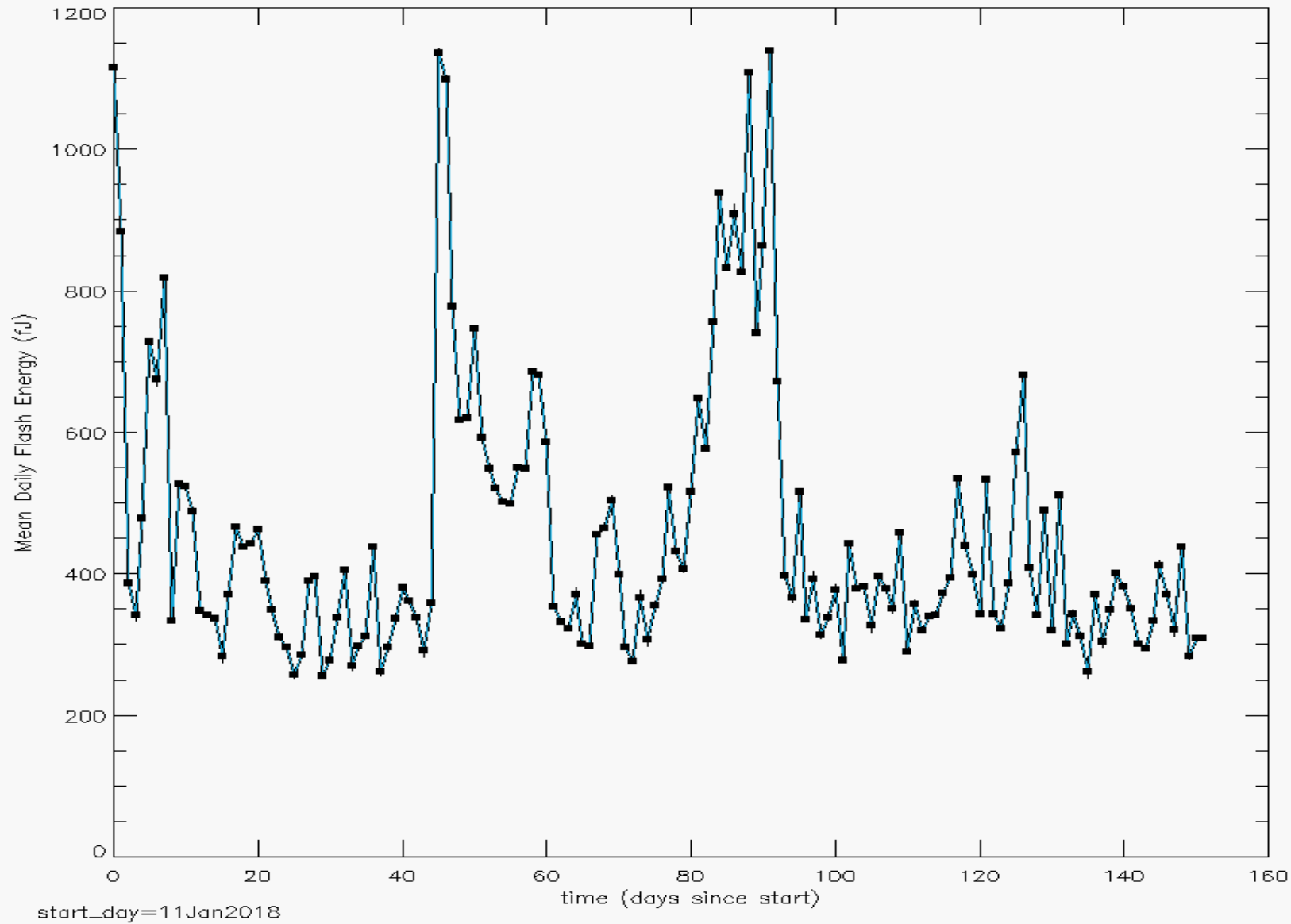


Fig. 4. Sample diurnal variation of the 3-day (Feb 22-24, 2018) mean flash energy v. local time.

Koshak et al., 2018: XVI ICAE,
17-22, June Nara, Japan

Trend of Daily Mean Energy



152 day Trend of Daily Mean Flash Energy (no energy filter)